List of Abstracts – Plenary talks ESU10

History of mathematics for the Million

Snezana Lawrence

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PL - Theme 1

In the Western world today, mathematics is often perceived as an abstract and daunting discipline, remote from everyday life and accessible only to a select few. This perception alienates many people and contributes to widespread mathematical anxiety. In this talk, I will address these challenges by advocating for the role of the history of mathematics in reshaping public attitudes.

Through exploring mathematical history, we can move beyond abstract concepts and algorithms to understand what it truly means to engage with mathematics. History allows us to see mathematics not merely as a body of knowledge, but as a human endeavour that has evolved alongside diverse cultures and historical periods. We can ask: What problems were mathematicians of the past trying to solve, and how did they approach them? What motivated their mathematical investigations? By examining stories from ancient Babylon to modern-day discoveries, we reveal mathematics as a living, dynamic process rooted in human curiosity and creativity.

But how does mathematics education feature these problems in general education? I will argue that to change this perception it is important to engage whole population and not only those who learn mathematics in schools and colleges, but their families also.

The principles I will discuss are drawn from my book, *A Little History of Mathematics* (Yale University Press, 2025), which spans 35,000 years of mathematical development, from prehistoric counting to cutting-edge research in the 21st century. Written with this public in mind, the book presents short, engaging episodes that showcase the diversity and richness of mathematical thought throughout history. My aim was to create a resource that could spark conversations between generations– encouraging teenagers, parents, and grandparents alike to reflect on how mathematics has shaped different civilizations and how its universal appeal allowed us to have a universal discipline underlying our communications and technologies from philosophy to software engineering and many other practical applications.

By grounding mathematical concepts in stories of real people and their challenges, we can inspire a more inclusive and appreciative view of mathematics. I will suggest further readings that build on these ideas, including Glen Van Brummelen’s *The Mathematics of the Heavens and the Earth*, Jacqueline Stedall’s *Mathematics Emerging*, and George Gheverghese Joseph’s *The Crest of the Peacock*. Through such explorations, we can help demystify mathematics and reveal its profound human significance.

Snezana Lawrence is a historian of mathematics based in the UK, known for making mathematics engaging and accessible through her writings and educational work. Her books are *A Little History of Mathematics* (2025), *Mathematical Meditations* (2025), *A New Year's Present From a Mathematician* (2019), and *Mathematicians and Their Gods* (2015), each weaving historical insights with captivating storytelling. Beyond her publications, Snezana has significantly impacted mathematics education through her work on the history of mathematics.

She was on the advisory panel redesigning the National Curriculum in Mathematics in UK in 2014, arguing for inclusion of the history of mathematics; served as Chair of the History and Pedagogy of Mathematics International Study Group (2020–24) and was the first Education Officer of the *British Society for the History of Mathematics*. She is the Assistant Editor of the *British Journal for the History of Mathematics*, overseeing the educational submissions and contributes to international journals, including the *Nexus Network Journal*.
Since 2015, she has held visiting positions at Masaryk University (Czech Republic), the University of Lorraine (France), and the University of Kragujevac (Serbia). She also advises the University of Aveiro on research related to the history of mathematics.

The importance and challenge of incorporating original mathematical texts in the classroom

Fàtima Romero-Valhonesta PL - Theme 2

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In teaching mathematics, we do not always convey to students the process of mathematical creation, how mathematical ideas evolve. We believe that mathematical instruction should include introducing students to the genesis of at least some mathematical ideas, lest they think that mathematical ideas or theorems arise spontaneously from privileged minds. One way of doing this is by way of original mathematical texts.

The difficulty of using original texts in the classroom is that not all historical texts or all sources are appropriate to design activities to implement in the classroom. What criteria should be used to select texts? Obviously, there should be some relationship to topics of the curriculum. Surely, our preferences will also play an important role, but no matter how interesting a text may be to us, we must think about how relevant it will be for students to learn the mathematical concepts involved. And how should we use these texts? Is it enough to read and comment on them in class to learn mathematics? For some texts, that may be the case, but for most of them it is necessary to add some guidelines for students to understand and in order to focus on the content we want them to learn. We can choose problems from ancient texts, present them to students and compare the ways they have found solutions with the way the author has resolved them. Or we can give students some excerpts that allow them to follow certain reasoning. Of particular interest are works written in the form of a dialogue, such as Plato's Dialogues and various works from the Renaissance.

In this lecture we will reflect on the importance of the history of mathematics for learning mathematics, specifically, on the criteria for choosing appropriate texts, that is, what characteristics a historical text must have for it to be helpful in learning mathematics. We will discuss how to implement such texts in the classroom, and we will present some examples from different topics and various disciplines such as probability or algebra.

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Fàtima Romero Vallhonesta has a degree in Mathematics from the Universitat de Barcelona (UB) and a PhD in History of Science from the Universitat Autònoma de Barcelona (UAB). She worked as a secondary school teacher at the Alexandre Satorras Secondary School in Mataró and then as an Inspector of Education for the Generalitat de Catalunya. These roles were compatible with giving Geometry classes to undergraduate students of Primary Education at the UAB. In addition, she gave Calculus classes at the Escola Tècnica Superior d'Enginyeria Industrial de Barcelona (ETSEIB). Now retired from her main job, she is a member of a Research Group of the Universitat Politècnica de Catalunya (UPC), and also a member of the History Group of the Associació de Barcelona per l'Estudi I Aprenentatge de les Matemàtiques.

Further, she is a member of the Museu de Matemàtiques de Catalunya (MMACA) with which she collaborates in some activities. Her research focuses on the history of mathematics through two main lines of investigation. The first one deals with the algebraization of Mathematics that took place from the 16th to the 18th century, specifically in the Spanish works written at the beginning of this period. The second area of investigation is related to the use of History of Mathematics in the school curriculum in order to find texts which can be instrumental in the learning of mathematical concepts.

History of mathematics for future teachers, in a nutshell

Alain Bernard PL - Theme 3

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In one of his illuminating papers on the "use" of history of mathematics in the classroom Man Keung Siu (2007) posed a problem that was meant not only to reveal the concrete problems experienced by teachers when trying to introduce history into their courses and teaching but also to address the challenge of defining of what it means for him, as a teacher trainer, to dispel the underlying misunderstanding about what is at stake in this introduction of a historical perspective in one's teaching. How can one explain, in simple terms or with simple means, that the whole point is not about *knowing* history of mathematics, but about *understanding* its value and depth for key issues about the teaching of mathematics? In other words, Siu transformed a question from teachers, into a question for teacher trainers and historians.

These traditional questions are still fully relevant. They are furthermore reinforced today by the explosion of "teaching assistants" ranging from lists of references, video clips, AI apps, and online historical documents, all designed to assist effective teaching. In many cases these "aids" ultimately come to constitute a heavy set of constraints, essentially because providing "online resources" does not amount to creating the conditions to develop true and "living" resources (Trouche et alii, 2020). Although this question has long been explored by researchers in math education (Pepin et alii, 2017) and is well known to teacher trainers, in a world in which the lack of resources is apparently no longer a problem, we still need to ask how we can help people make the best of the host of "resources" available to them, especially when those resources are presented in a form that does not always facilitate their appropriation. Online resources for integrating history of mathematics in math teaching does not escape these dilemmas.

Being confronted, like anyone else, with these old and newer questions, I recently developed a videographic project with several colleagues and institutions (Bernard et alii, to be published). The purpose was to confront the above-mentioned dilemmas and offer a rich answer to the questions posed by some of my students about the quality of some video clips on history of mathematics available during the COVID crisis: what was their historical value and pedagogical interest? What could they do with this? The decision to produce our own series of videos clips initially followed a double intention. The first was to convey, in a *nutshell* – that is, within the hard constraint of 6 or 7-minutes clips – some kind of deep meaning about history of mathematics and its interest for teaching. The second was to provoke some kind of critical thinking about the videographic support itself. Beyond these initial intentions, it soon appeared that the collective creation of such video clips had an interest by itself, either to reflect or to trigger new questions. This project will thus serve me to illustrate the underlying issues related to the development of such "teaching aids", taking the form of a "nutshell", and meant to convey a sense of history about their chosen subjects.

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Alain Bernard is assistant professor at University Paris Est Créteil in the institute for teacher training (INSPE). As historian of mathematics and mathematical sciences he works today on 18th cent. mathematics after a period in which he contributed to the history of late antique mathematics. He belongs to Centre A. Koyré (Aubervilliers) and contributes to several collective research teams, mainly the ENCCRE project (online critical edition of Diderot's and D'Alembert's *Encyclopédie*) as also the inter IREM group. For example, he published a "dossier critique" associated to the article "PROPOSITION, en mathématiques", in Édition Numérique Collaborative et CRitique de l'Encyclopédie, 2022 (available online at `https://enccre.academie-sciences.fr/encyclopedie/`).

The Local and Global History of Early Modern Mathematics: Material Culture as a Key

Samuel Gessner

Portugal

PL - Theme 4

Can a local museum inspire and challenge students of mathematics? The recreational side of mathematics has a long history – one that can be uncovered through museum heritage. This talk explores examples from the material culture of early modern mathematics, including manuscripts, early prints, and instruments. While mathematical concepts, techniques, and results can have global reach, mathematics has always been practiced within specific communities, places, and historical contexts. Local histories of mathematics offer a richer perspective on both the subject and the past of our own localities.

This talk presents a model of interdisciplinary collaboration that can be replicated anywhere. Since 2021, we have been developing a pilot project in Lisbon involving a mathematics teacher, museum staff, a product designer, and a historian of mathematics. Together, we have created low-cost models of historical instruments, inspired by authentic objects in local museums. These models serve both to engage students in mathematical reasoning and to foster inquiry into the mathematical past of their city.

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Samuel Gessner is an assistant researcher at the Center for History of Science and Technology (CIUHCT) and an invited professor at the Department of History and Philosophy of Science of the Universidade de Lisboa.
His research focuses on the diverse mathematical cultures in medieval and early modern Europe. He examines how they interacted by studying the role of mathematical and astronomical instruments as conceived by both theoreticians and practitioners. He emphasises using artefacts of material culture as primary sources, in particular mathematical and astronomical instruments, alongside textual documents.

Mathematics Education in Secondary Schools for Boys in 19th-Century Poland: Schools with Polish, Prussian, Austrian, and Russian Curricula

Karolina Karpińska PL - Theme 5

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At the end of the 18th century, Poland was partitioned three times. As result of the third partition in 1795, Poland vanished from the map of Europe, with its lands seized by three powers: Prussia, Russia, and Austria. Consequently, in the 19th century, schools in Polish territories operated under Polish, Prussian, Russian, and Austrian educational systems. This paper discusses the distinctive features of mathematics education according to which of these systems was implemented. Special attention is given to schools preparing students for matriculation examinations, such as gymnasia and real-type schools. Curricula, textbook contents, and sets of matriculation exam problems are characterized. Scientific publications by teachers are particularly valuable in this context, as they frequently discussed selected topics covered in schools. These publications provide insight into how teachers independently modified curricula to best prepare students for efficient functioning in everyday life as well as for university studies. Special attention is paid to the application of arithmetic and algebra in daily life, specifically, the so-called "citizen calculations", which include the calculation of pensions, annuities, and financial transactions related to banking. Moreover, in the 19th century, geometry was highly valued in Polish territories; depending on the period and whether Polish, Prussian, Russian, or Austrian curricula were in place, the focus varied between construction problems, surveying, analytical geometry, and descriptive geometry. It was believed that, alongside its practical applications, one of the main advantages of geometry was its ability to develop logical thinking skills, especially in the context of conducting complex, multi-step geometric constructions.

In the 19th century, secondary schools for boys preparing students for matriculation exams offered comprehensive curricula. Innovations in science were often quickly integrated into these programs. For example, in 1812, elements of descriptive geometry were introduced into schools with Polish curricula based on the works of Gaspard Monge and Jean N. Hachette. This advancement was made possible by a well-educated teaching staff – many secondary school teachers held doctoral degrees. Therefore, to provide a complete picture of mathematics education, this paper also highlights selected teachers, their professional qualifications, and their scientific and educational activities.

During the presentation, examples of 19th-century mathematics problems will be solved. The topics discussed in this paper may serve as material for contemporary teachers to incorporate elements of the history of mathematics education into their lessons.

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Karolina Karpińska is assistant professor in the Institute for the History of Science, Polish Academy of Sciences. In 2017, she received her PhD in the history of mathematics. Her current research is related to the history of mathematics education, with particular attention paid to the Polish territories in the 1795–1918. At that time, Poland was occupied by three empires: Prussia, Austria and Russia, and consequently there were schools with Polish, Prussian, Austrian and Russian curricula and relevant languages of instruction.

She has published several papers in this field, including: "Gnomonics in Secondary School Education in the Territories of Poland in the 17th–20th Centuries", in *Advances in the History of Mathematics Education* (Springer, 2022); " ‘Denominate numbers’ in mathematics school textbooks by Stefan Banach", *Historia Mathematica* 59(2022), and "Mathematics teaching at girls’ Victoriaschule in Gdańsk from the mid-19th century until World War I", *Journal of Mathematical Behavior* (2025).

Indian mathematics, a source for a globalized history of mathematics

Jean Michel Delire PL - Theme 6

Belgium

The mathematics developed in India is mostly unknown on this side of the Eurasiatic continent. Yet, the Indians elaborated, for more than three thousands years, several tools, sometimes comparable to those of contemporaneous civilizations. This is the case with the so called Pythagoras theorem, by instance, whose statement appears in the frame of the Vedic sacrificial ritual, elaborated more than one thousand years before Christ. The specific requirements of this ritual demonstrate geometrical knowledge which was collected in treatises, the Śulbasūtras, composed around Pythagoras'time. Other tools appeared in India long before they appeared in other civilizations, for example, the positional decimal system and negative numbers. In the first instance, the tendency to give to the powers of ten very different names, i.e. not built on the same root (as thousand), and the versification constraint in the composition of scientific texts explain the emergence of the positional system. In the second instance, the resolution of problems by numerical algorithms rather than by geometrical methods, allowed to give to negative numbers a status. These algebraic methods appeared in the first centuries of the Christian era, certainly before Āryabhaṭa, the first Indian mathematician-astronomer (5th c.) known by name.

In this lecture, I will develop these different points with the help of extracts from texts and iconography showing the role of Sanskrit, the language of the Indian literari. Indeed, this Indo-European idiom, akin to Greek and Latin, enabled Indian mathematicians to write equations before the word algebra appears in the famous book of al-Khwārizmī. The conditions for developing equations certainly already existed at Āryabhaṭa's time, as is shown by Bhāskara in his commentary to the Āryabhaṭīya (629). But the syncopated notation of these equations had especially been advanced by Brahmagupta in his *BrahmasphutaSiddhānta* (628) and by Bhāskarācārya in his entire work (12th c.). We shall note, in particular, the negative value of a number signaled by a dot above it, the arrangement in columns (second degree, first degree, fixed value) of the coefficients of an equation and the superposition of its two members, to represent an equality.

Of course, I will exemplify these points by pedagogical activities applicable in the classroom. Some of them have been tested in Belgian secondary schools, either on the occasion of the festival Europalia-India in 2013-2014 (see ESU 7 Acts, Copenhague), or by some of my students at the *Haute École de Bruxelles-Brabant* within the framework of their educational internship or their final dissertation.

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Jean Michel Delire holds a degree in mathematical sciences and a PhD in philosophy and literature from the University of Brussels (ULB), with a thesis on the oldest Sanskrit texts with mathematical content. This thesis was published by Droz, Geneva, in 2016.
For fifteen years now, he has focused his research on the mathematical and astronomical works of Raja Savai Jai Singh II (1689-1743) of Jaipur, Rajasthan, where J.M. Delire frequently resides, as well as on the contributions of Jesuit missionaries to the understanding of Indian science during the same period.
J.M. Delire has taught mathematics at the high school level and the history of mathematics at the university level. He is currently lecturing a course on History of Mathematics and on Science and Civilization of India – Sanskrit Texts, at the Institute of Advanced Studies of Belgium at ULB. He edited *Astronomy and Mathematics in Ancient India* (2012) and *Art et Savoir de l'Inde* (2015), for the occasion of Europalia-India. He is also the author of *Mathématiques multiculturelles* (vol. I, 2018) and numerous articles.

Mathematics in Early Modern Portugal: The challenge of the sea

Henrique Leitão

PL - Theme 7

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Mathematical activities in Portugal during the 15th to 17th centuries, both theoretical and practical, were profoundly influenced by the country's maritime expansion: transformations in mathematics occurred across social, institutional, intellectual, and symbolic domains. While the effects of oceanic navigation were initially evident in Portugal, similar developments occurred in all nations engaged in large-scale maritime enterprises, particularly Spain, England, and the Netherlands.

Technological demands of oceanic navigation soon highlighted the need for close collaboration between university-trained mathematicians and practical professionals, such as pilots, mariners, instrument makers, and cartographers. A wide array of new questions in astronomy, cosmography, cartography, and instrument-making required the expertise of skilled mathematicians. As a result, mathematical talent was redirected toward solving the novel challenges posed by seafarers and cosmographers. The social landscape for the practice of mathematics was significantly altered due to these demands: circles of mathematical experts working with mariners emerged; new institutions were established to facilitate these collaborations; novel programs for the mathematical education of maritime personnel were implemented; and mathematical consultants were employed by the crown, the aristocracy, and commercial enterprises.

The influence of maritime exploration was also felt at the theoretical level. Long-distance voyages brought about considerable transformations and advancements in mathematics. A new, mathematically-based "science of navigation" had to be developed, a deeper understanding of the geometry of nautical charts was required, and substantial changes were made in mathematical cartography. The exploration of the Earth on a planetary scale gave rise to critical new problems in cosmography and cartography. Groundbreaking concepts, such as the loxodromic curve and Mercator's projection, were directly linked to this new maritime reality.

Perhaps the most profound impact was felt at even deeper levels. Mathematics gained a newfound prominence within the hierarchy of knowledge, and the awareness of its practical utility was significantly heightened.

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Henrique Leitão is Senior Researcher at the Department for the History and Philosophy of Science at the University of Lisbon, Portugal. His research interests are centered on the history of 16th-17th cent. cosmography and cartography. He is the author or editor of more than 20 books; the most recent (with J. M. Moreno Madrid), is: Drawing the Gateway to the Pacific. Maps, Charts and Other Visual Representations of the Strait of Magellan, 1520-1671. He is member of various learned societies, including the Lisbon Academy of Sciences and has been awarded several academic prizes and distinctions. In 2018 he received an Advanced Grant by the European Research Council.

European Summer Universities (1993-2025): more than thirty years of sharing

Évelyne Barbin Special PL

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1993 was the year of the first ESU in Montpellier (France). There were 244 participants in Montpellier, coming from France and 29 other countries. It was organized by the French inter-IREM Committee "Epistemology and History of Mathematics," and it was the fifth French Summer University after Le Mans (1984), Toulouse (1986), La Rochelle (1988), Lille (1990). ESU meetings are marked in three distinct ways: they are open to secondary teachers, they welcome interdisciplinarity, and they have three official languages: English, French, and the language of the ESU host country. After 1993, ESU meetings were organized in Portugal, Belgium, Sweden, Czech Republic, Austria, Denmark, Norway and Italy, thanks to colleagues who accepted to be organizers. In my talk, I will come back to all the meetings and to their success along the 30 years of ESU.

Évelyne Barbin obtained a thesis in theoretical computer science and a habilitation thesis in history of mathematics. Since 2002, she is full professor of epistemology and history of sciences at the University of Nantes (France) and, since 2014, professor emeritus. She is member of the Laboratory LMJL and the group "History of mathematics and teaching" of the IREM (Institute for Research on Mathematics Education) of Nantes. Her research concerns three fields: history of mathematics, history of mathematics teaching; relations between history and teaching of mathematics. She worked on epistemology and history of mathematics in the IREM institutes since 1975.

She co-organized 20 colloquia, 8 summer universities and the first European Summer University (ESU) "Epistemology and History in Mathematics Education" in 1993. She was co-chair of nine ESU from 1996 to 2024. Since 1980, she is a member of the "International Study Group on the Relations between History and Pedagogy of Mathematics" (HPM). She was chair of HPM from 2008 to 2012 and HPM-2012 in Daejeon (South Korea).